HINGED ELECTRONIC DEVICE

The invention relates to a hinge structure for rotatably connecting two parts of a foldable electronic device to each other, the hinge structure comprising a hinge, about the rotation axis of which the parts are rotatable with relation to one another, and at least one spring element which controls the operation of the hinge.

DESCRIPTION OF THE PRIOR ART

The invention also relates to a hinged electronic device.

Some electronic devices are foldable comprising a base part and a cover part rotatably connected thereto by hinge means. Such electronic devices—in the following referred to as the device—are typically e.g. mobile telephones, laptops, communicators, portable computers and the like. To improve portability and manageability of the device, for instance, the base part and the cover part of the device can be folded against one another. On the other hand, by folding the device open, i.e. the cover part apart from the base part, a display extending substantially throughout the cover part, and correspondingly, a keyboard extending substantially throughout the base part will be generally available for use. The device may comprise more than two parts that rotate with relation to one another.

Means that control the rotation movement are generally arranged in the hinge structure of the device, such as friction means, which provide a pleasant response to the rotational movement by resisting the rotation of the parts with relation to each other in a suitable manner, and on the other hand, which lock the parts at a desired angle. In addition, the hinge structure may comprise specific locking means for keeping the device open in an operating position. For instance, EP 801,489 discloses a solution in which locking into operating position is arranged such that springs arranged at the axis of the hinge axially force a first pivot pin having grooves at one end and being connected to the first part of the device end-on-end against a second pivot pin connected coaxially to the second part of the device, ridges provided at the end of the second pivot pin locking in said grooves at a predetermined opening angle.

Friction elements integrated with hinge structures are often rather complicated comprising several small components and therefore the manufacture and assembly thereof is relatively cost intensive. Moreover, as a result of repeated opening and closing of the device, the friction of the friction elements gradually reduces and thereby the rotating properties become less precise.

The device must also be lockable to a completely closed position, in order that it would not open unintentionally. Locking is generally implemented by locking means comprising a plurality of components and thus causing component and assembly costs, and in time, the reliability of the locking means may deteriorate.

When the device is opened into an operating position, it must naturally stand steadily, in other words, a force vector of the mass centre of the device must pass through a bearing area limited by supporting points in the base parts of the device. It is known to arrange the mass centre in the base part of the device by disposing a necessary amount of electronic components of the device in the base part. However, when the size of the display increases, or for some such reason, the weight of the cover part may proportionally increase such that the force vector of the mass centre is located on the edge of the bearing area or even outside it. Unsupported, the device will readily overturn to rest on the cover part, which substantially hampers the use of the device. On the other hand, if the display of the device is a touch screen, the device may relatively easily overturn to rest on the cover part while the display is touched, even though the mass centre would clearly be on the side of the base part. It is known to reduce the risk of overturn by arranging in the device a mechanical supporting structure which extends the bearing area of the device under the cover part. The supporting structure is an extra structure causing extra costs in the device. In addition, the supporting structure imposes restrictions to the device design and may also have a negative effect on the appearance of the device.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a hinge structure and a hinged electronic device which avoid the above-mentioned disadvantages.

The hinge structure of the invention is characterized in that a spring element is rotatably attached at its first end to an attachment means arranged in the cover part and at its second end to an attachment means arranged in the base part such that either end may freely rotate in their attachment means about an imaginary rotation axis that is substantially parallel with the rotation axis of the hinge.

The hinged electronic device of the invention is characterized by comprising at least one hinge structure according to claims 1 to 13.

The basic idea of the invention is that the hinge structure is implemented without friction elements such that the hinge is a simple means enabling the rotation of the device parts, and a spring element controlling said means is positioned outside the hinge and attached at its first end to the cover part and at its second end to the base part such that either end may rotate freely at their attachment point about an axis that is substantially parallel with the rotation axis of the hinge. The idea of one preferred embodiment is also that after the opening angle of the device has reached a given limit angle, spring force of the spring element forces the device parts into a given, predetermined operating position. Further, the idea of a second preferred embodiment is that the opening angles being smaller than said limit angle, spring force of the spring element presses the parts against each other into a completely closed position. The idea of yet a third preferred embodiment is that while the device is open in the operating position, the spring element extends the bearing area of the device.

The invention has an advantage that one, simple, reliable and inexpensive structure provides required resistance in the hinge structure. Further, one preferred embodiment has an advantage that the hinge structure locks the device into operating position. Still further, a second preferred embodiment has an advantage that the hinge structure also locks the parts of the device in the closed position against each other. An advantage of yet a third preferred embodiment is that the spring element extends the bearing area of the device in the operation position under the cover part such that the device stands more steadily in an appropriate position.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following, the invention will be described in greater detail with reference to the attached drawings, in which

FIG. **1** is a schematic side view of an embodiment of a hinge structure of the invention in a completely closed position,

FIG. **2** is a schematic side view of the hinge structure of FIG. **1**, while a device is partly open,